The Impact of Community Design on Traveler Behavior

Susan Handy

UTC Spotlight Conference on Livability

Washington, DC ◊ October 18, 2010

UCDAVIS
SUSTAINABLE TRANSPORTATION CENTER
of the Institute of Transportation Studies



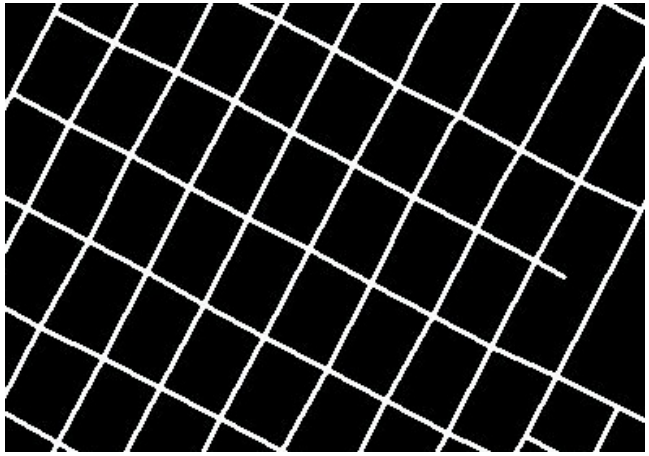
Community Design
= Built Environment

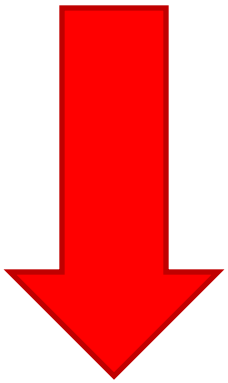
- Land use – what activities where
- Transportation system – how linked
- Design – aesthetic features

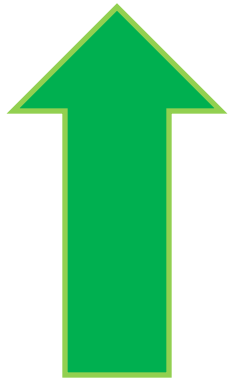
Community Design
= Physical Environment

- Land use – what activities where
- Transportation system – how linked
- Design – aesthetic features
- Natural landscape – trees, grass, etc.
- Human use – other people

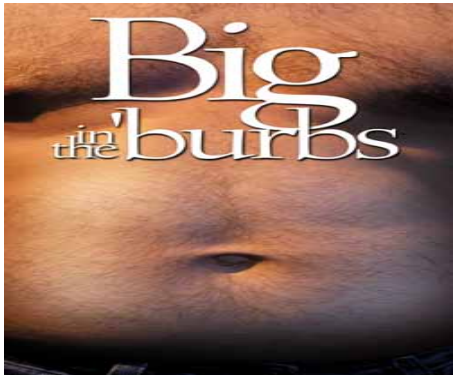

STARBUCKS
COFFEE



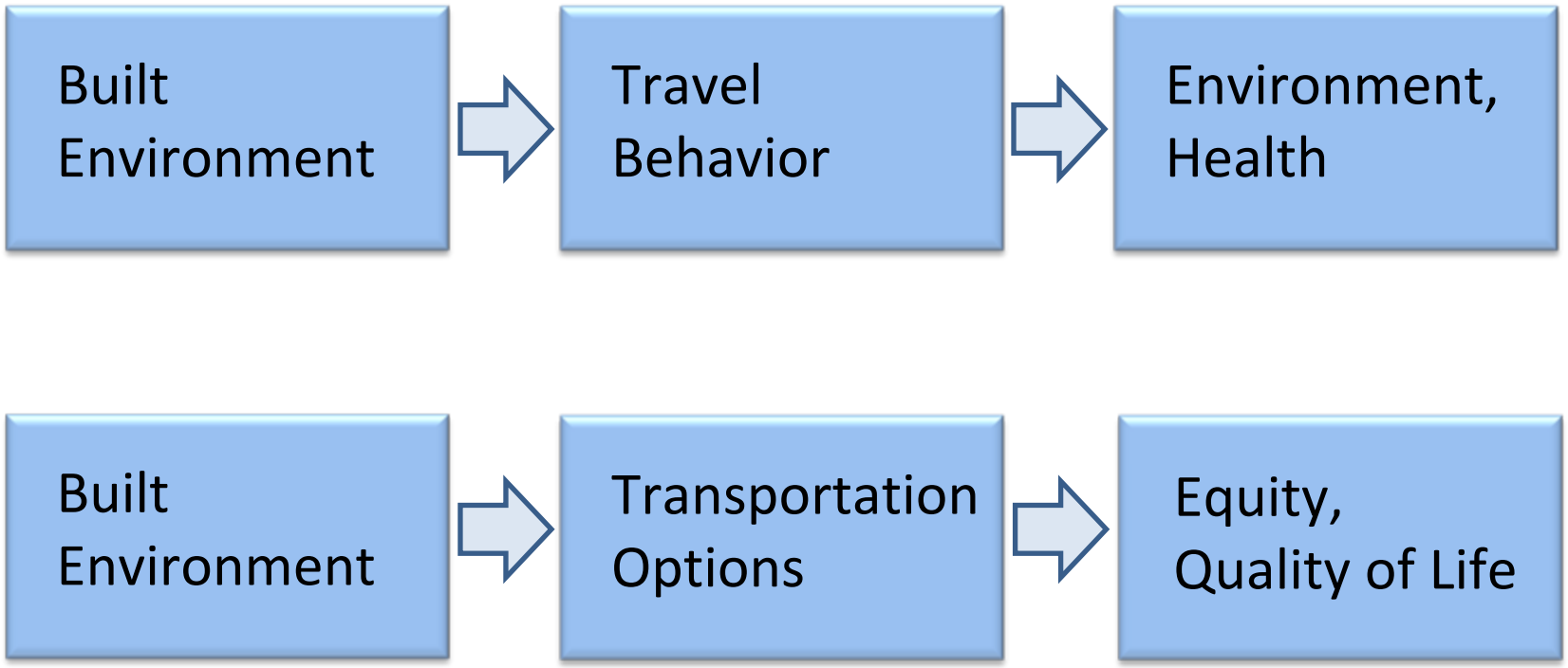





CLIMATE
CHANGE


Big
in' the burbs

Research Perspectives



So what impact does the built environment have on travel behavior?



Influence of Built Environment on Walking for Transport

Density	+
Land-use mix	+
Distance to destinations	-
Street connectivity	?
Pedestrian infrastructure	?
Traffic	?
Personal safety	?
Parks/open space	?
Aesthetics	?

Saelens and Handy, Medicine & Science in Sports & Exercise, 2008

Influence of Built Environment on Bicycle Commuting

Bicycle lanes and paths	+
Bicycle facilities	+
Distance to work place	-
Population density/urban location	+
Traffic conditions	?

Xing and Handy, International Journal of Sustainable Transportation, 2011

Influence of Built Environment on Transit Use

Density	+
Land use mix	?
Street connectivity	+
Regional accessibility	+
Proximity to transit	+

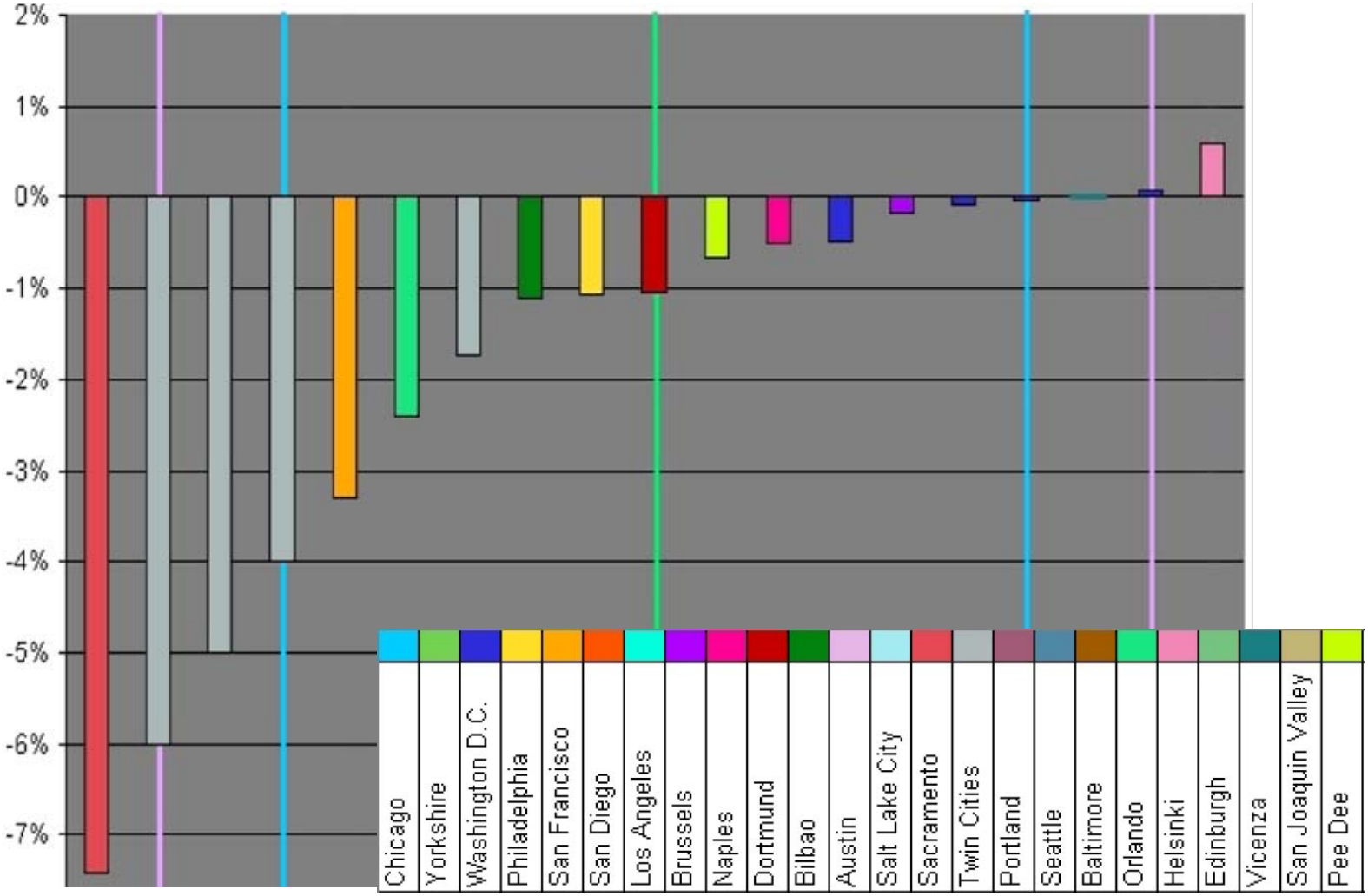
Ewing and Cervero, Journal of the American Planning Association, 2010

Elasticities for BE and VMT

	Weighted average	Range across studies
Household/population density	-0.04	-0.12 to 0
Job density	0	0 to 0.02
Land use mix	-0.09	-0.27 to -0.01
Jobs-housing balance	-0.02	-0.09 to 0.03
Intersection/street density	-0.12	-0.29 to -0.04
Percent 4-way intersections	-0.12	-0.15 to 0
Job accessibility by auto	-0.20	-0.31 to -0.03
Job accessibility by transit	-0.05	-0.10 to -0.03
Distance to downtown	-0.22	-0.27 to -0.20
Proximity to nearest transit stop	-0.05	-0.19 to -0.01

Ewing and Cervero, Journal of the American Planning Association, 2010

Modeling Studies: VMT Reductions from Land Use



Rodier, TRB Annual Meeting, 2009

But does this mean changes to the built environment necessarily lead to changes in travel behavior?

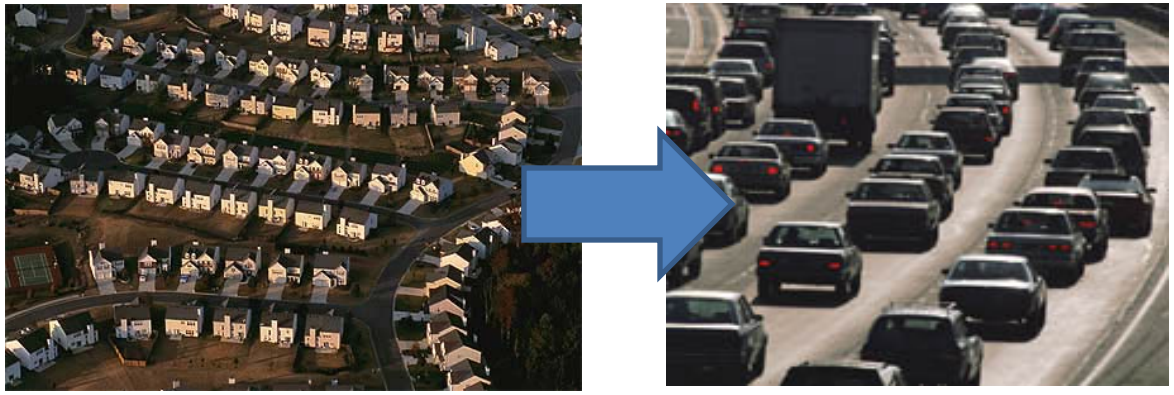


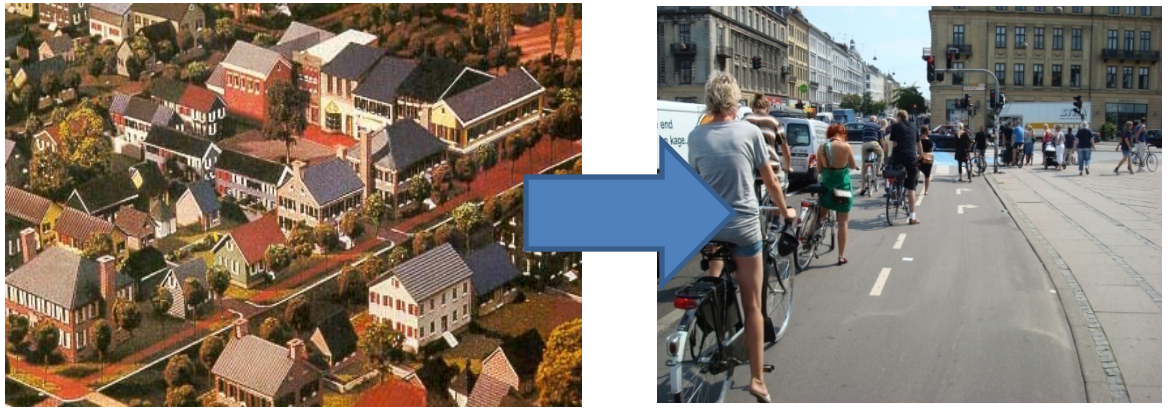
Association =

differences in land use associated with differences in travel

Causality =

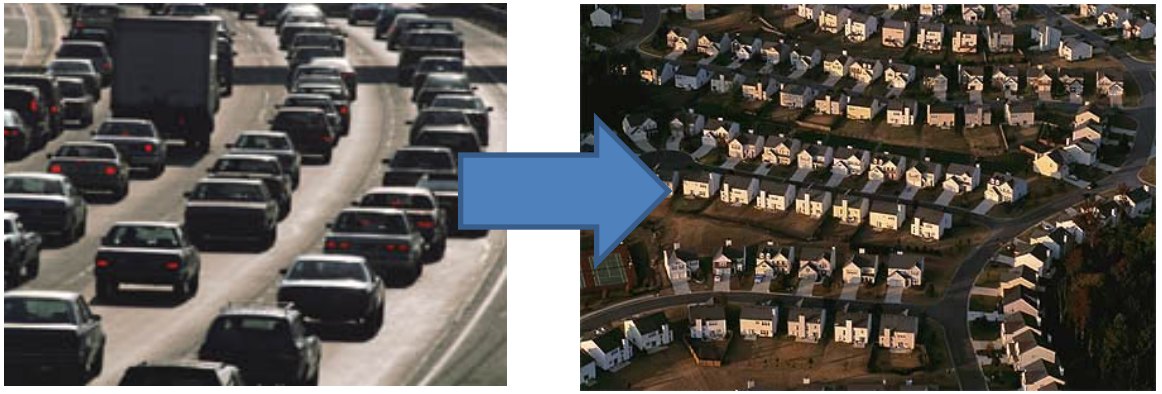
Changes in land use lead to changes in travel

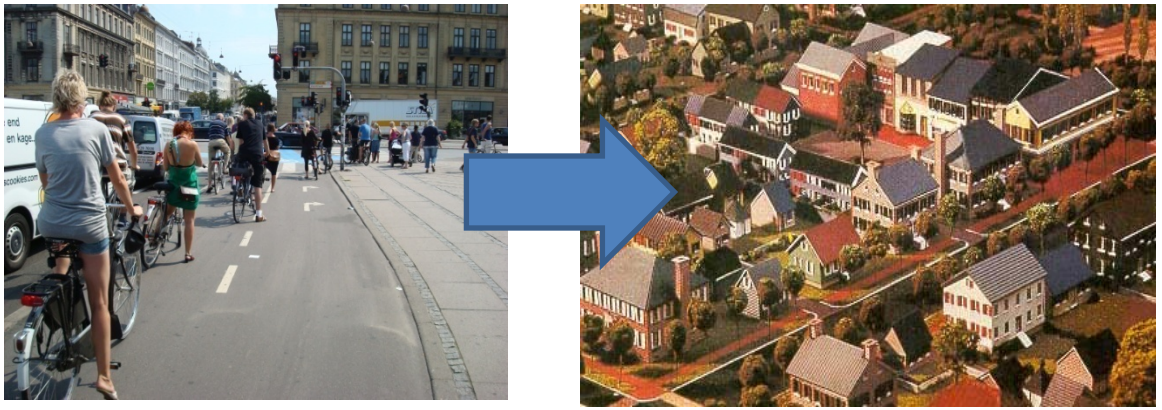




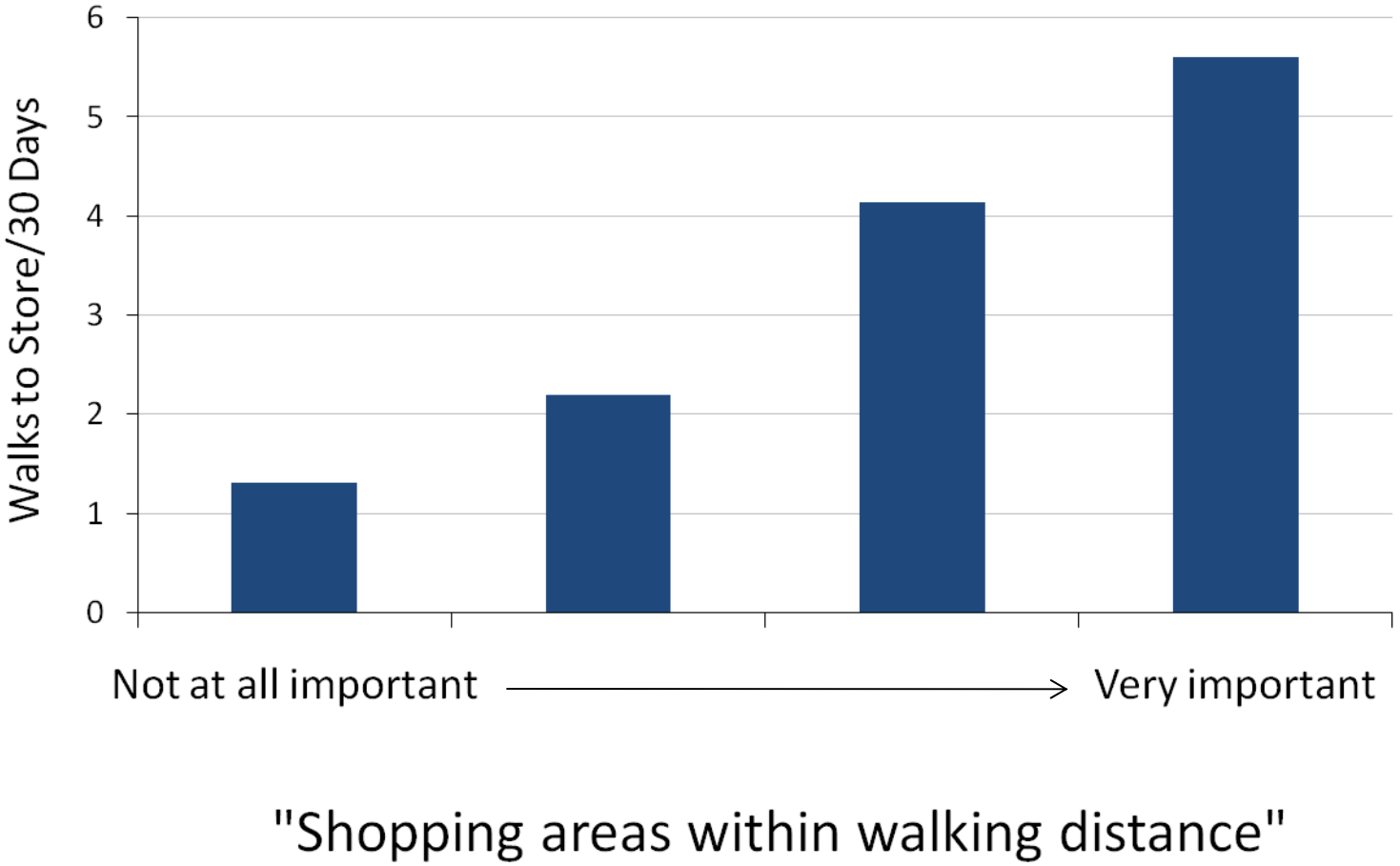
Self-Selection =

Preferences for travel influence type of neighborhood chosen





Walking to Store vs. Neighborhood Choice



Source: Handy, Cao, and Mokhtarian, 2006.

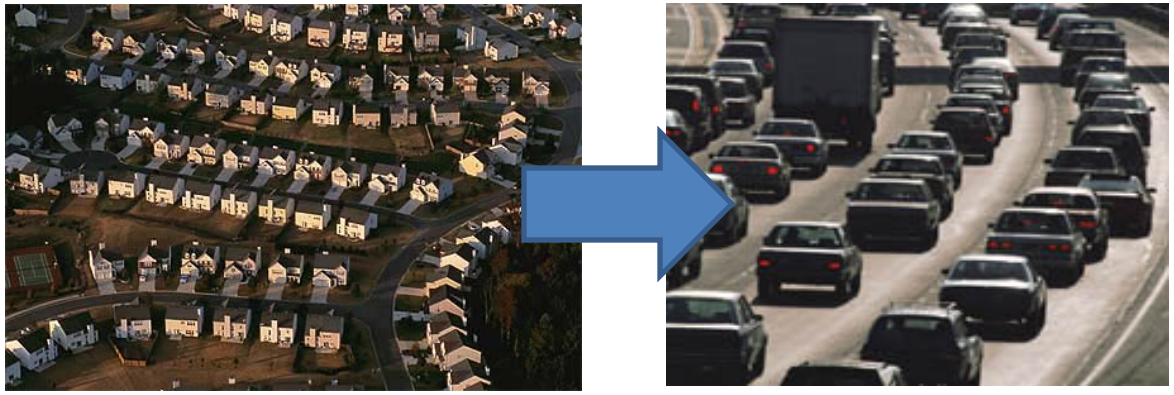
Self-Selection Evidence

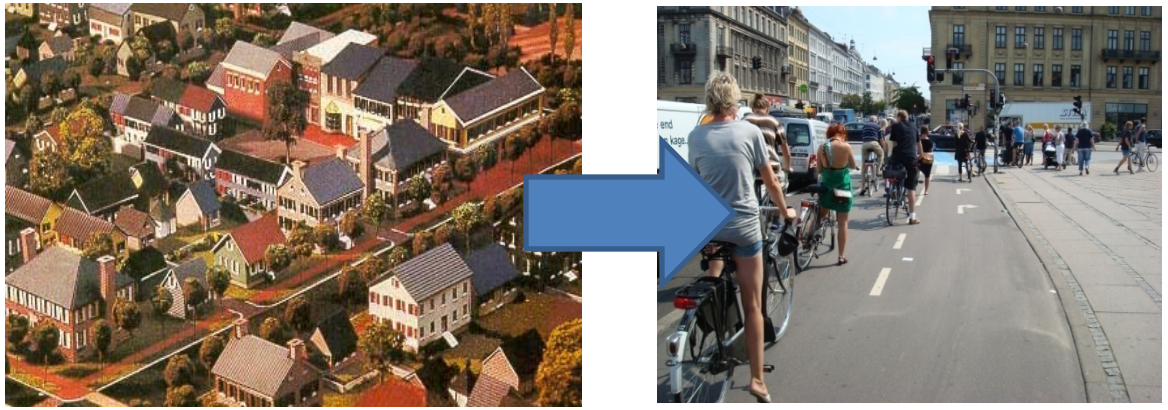
Effects Found	Number of Studies
Built Environment No Self-Selection	1
Built Environment AND Self-Selection	15
Built Environment (Self-Selection Controlled)	11
Built Environment > Self-Selection	8
Built Environment < Self-Selection	2

Source: Cao, Mokhtarian, and Handy, 2009

Causality =

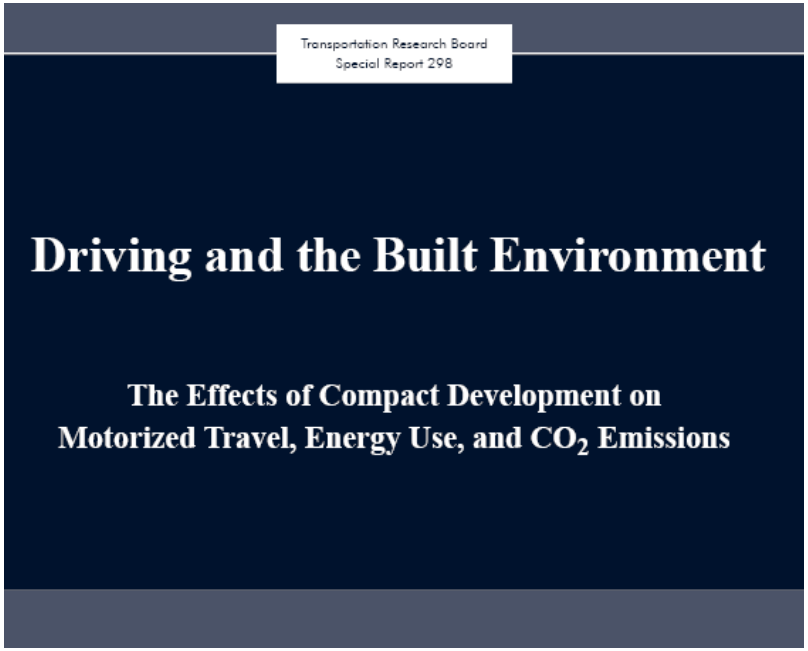
Changes in land use lead to changes in travel





TRB Special Report 298

"careful before-and-after studies of policy interventions to promote more compact, mixed-used development to help determine what works and what does not"



"Natural experiments"

"Intervention studies"

"Policy evaluation"

Evaluation Studies

Element	Issues
Treatment and control groups	What is the “treatment”? Who is the treatment group? What is an appropriate control group?
Measures of outcomes of interest	How to measure outcomes accurately? How to measure outcomes efficiently?
Before and after measurement	How long before the treatment? How long after the treatment?

Bike Intervention Evidence

Infrastructure Type	Effect
Bikeability	?
Bike Lanes	+
2-way travel on 1-way streets	?
Shared bus/bike lanes	?
Off-street paths	?
Signed bicycle routes	+
Bicycle boulevards	+
Cycletracks	+
Colored lanes	+
Shared lane markings	?
Bike Boxes	?
Bicycle signal phases	?
Maintenance	+
Wayfinding signage	?
Shortcuts and cut-throughs	?

Source: Pucher, Dill and Handy, 2010

California SR2S Study – UC Irvine

Work Type	Schools
Sidewalk improvements	Sheldon Elementary, West Randall Elementary (primarily sidewalks) Murrieta Elementary, Valley Elementary, La Gloria Elementary (includes other work types) Juan Cabrillo Elementary, Ocean Knoll Elementary
Traffic calming & speed reduction	La Gloria Elementary, Hawthorne Elementary
Pedestrian/bicycle crossing	Mt. Vernon Elementary, Jasper Elementary, Valley Elementary, Glenoaks Elementary
Bicycle facilities (on-street or off-street)	La Gloria Elementary, Murrieta Elementary
Traffic control devices	Cesar Chavez Elementary, Newman Elementary
Traffic diversion improvements	La Gloria Elementary, Sulphur Springs Elementary

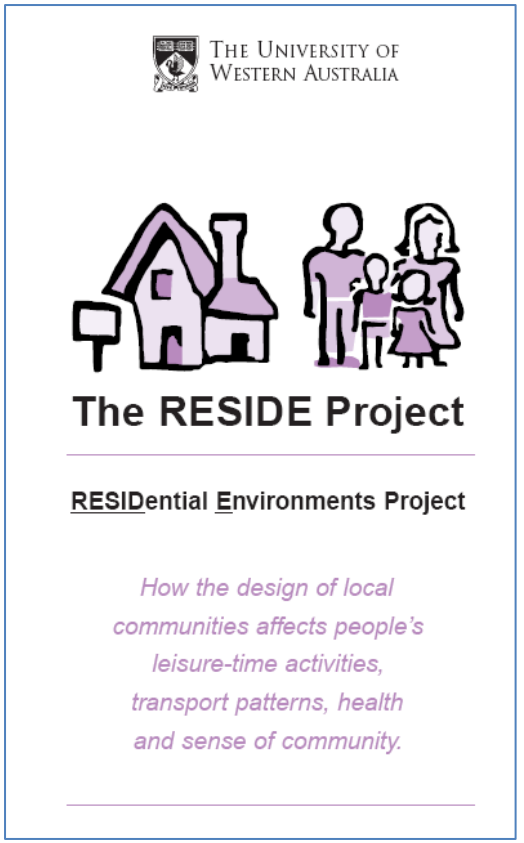
Note: Most projects with multiple work types are shown in multiple categories.

- Parents of 3rd and 5th graders surveyed before and after improvements
- Traffic counts and driver behavior before and after improvements
- *Increases in walking/bicycling at 5 out of 10 schools*

Source: Boarnet, M. et al. 2005. *Journal of the American Planning Association* (Summer).

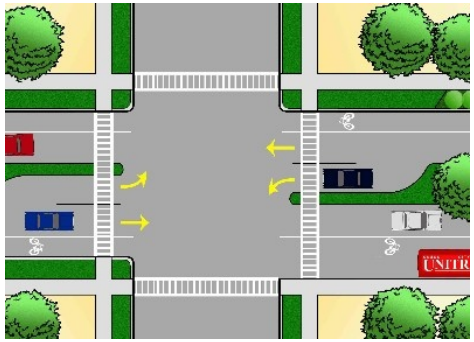
RESIDE Study – UWA, Perth

- 2003-2008
- 5000 new home builders invited to participate
- Surveys before move, one year after, two years after
- Environmental audits for BE characteristics
- *Steps per day did not change*



UC Davis Studies

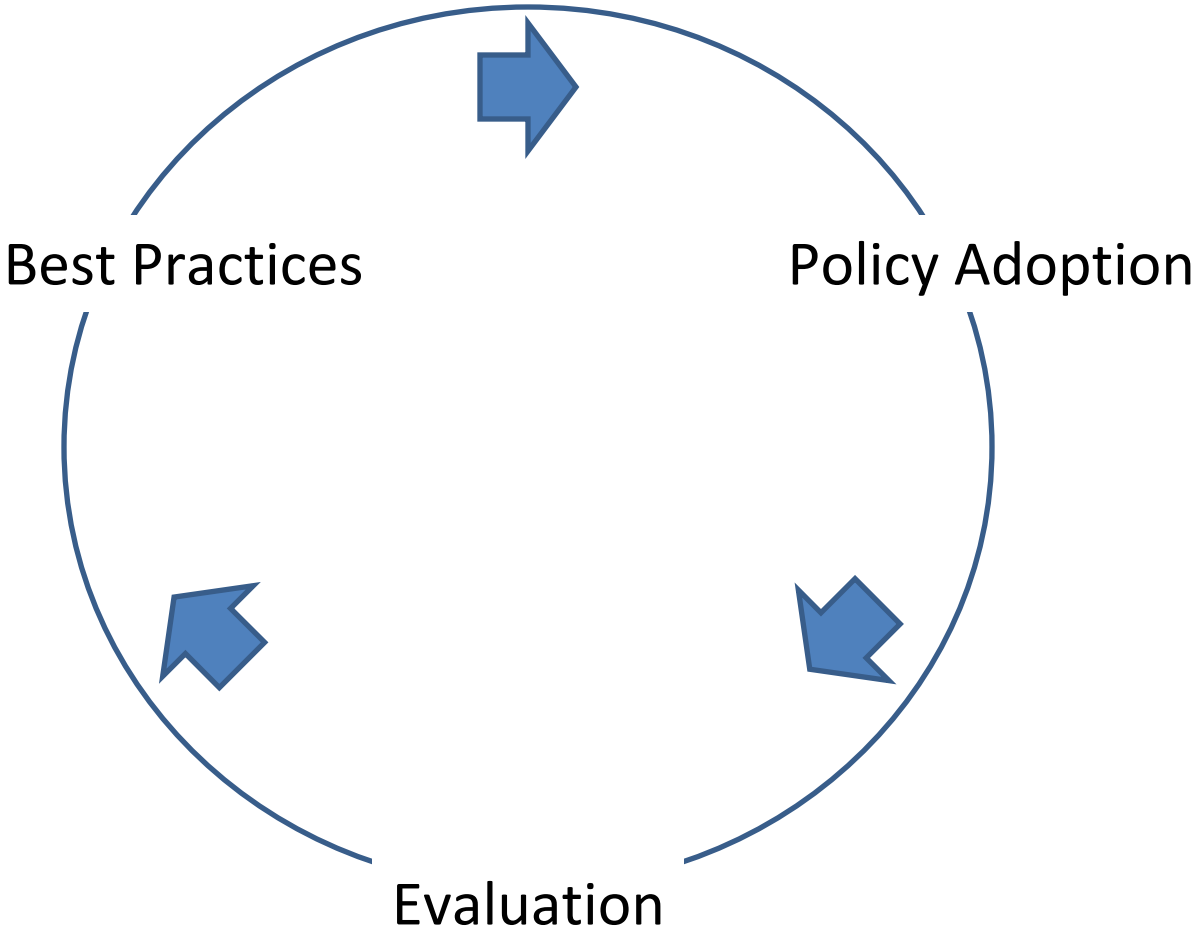
Target Store opening: Shopping patterns before and after



Fifth Street Road Diet: Mode split to downtown and bike/ped safety before and after

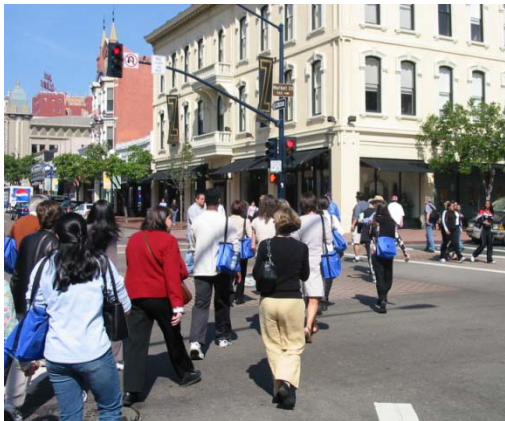
West Village Project: Travel patterns before-and-after moving in

Evidence Cycle

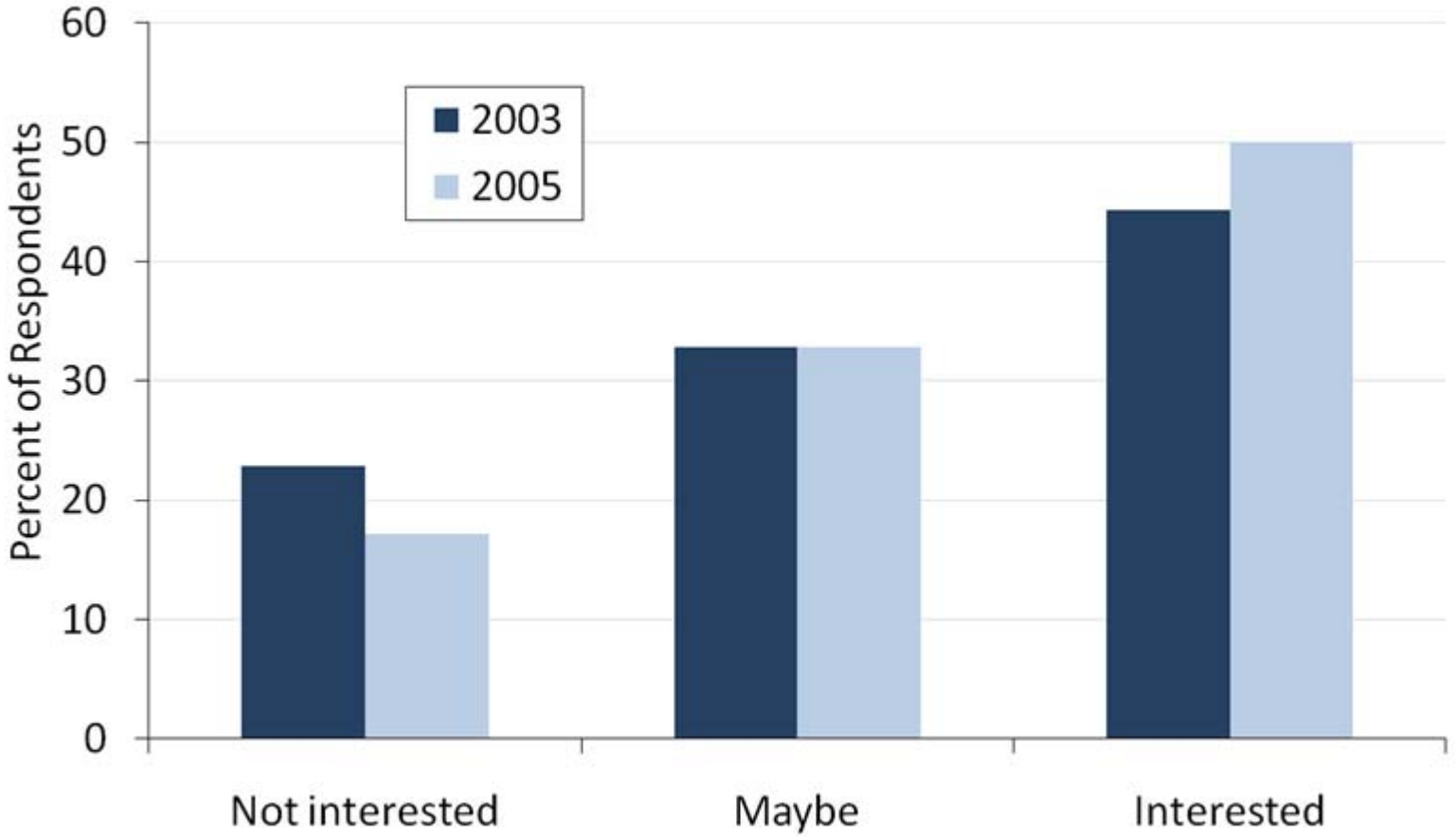


OK, but how much demand is there for places like this?



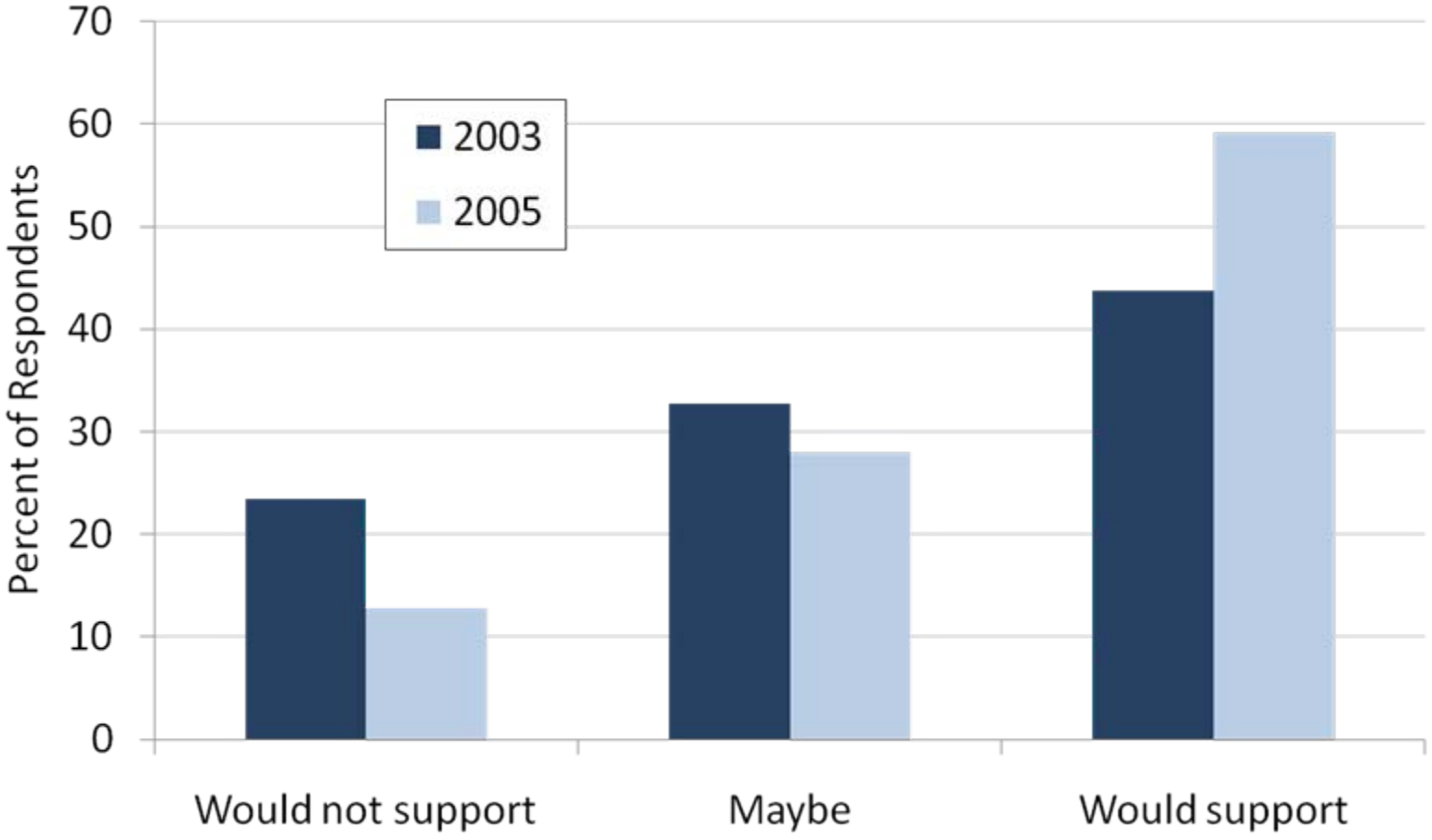


Interest in Living in Walkable Community



Source: Handy, Sallis, et al., 2008

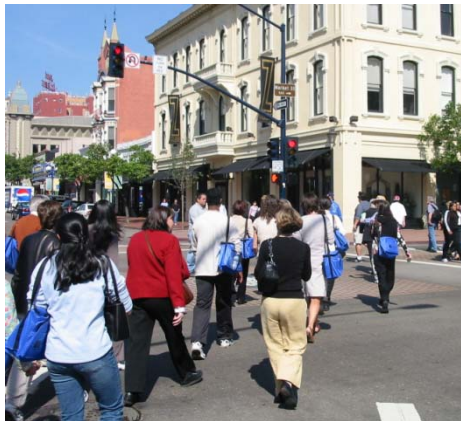
Support for Walkable Communities



Source: Handy, Sallis, et al., 2008

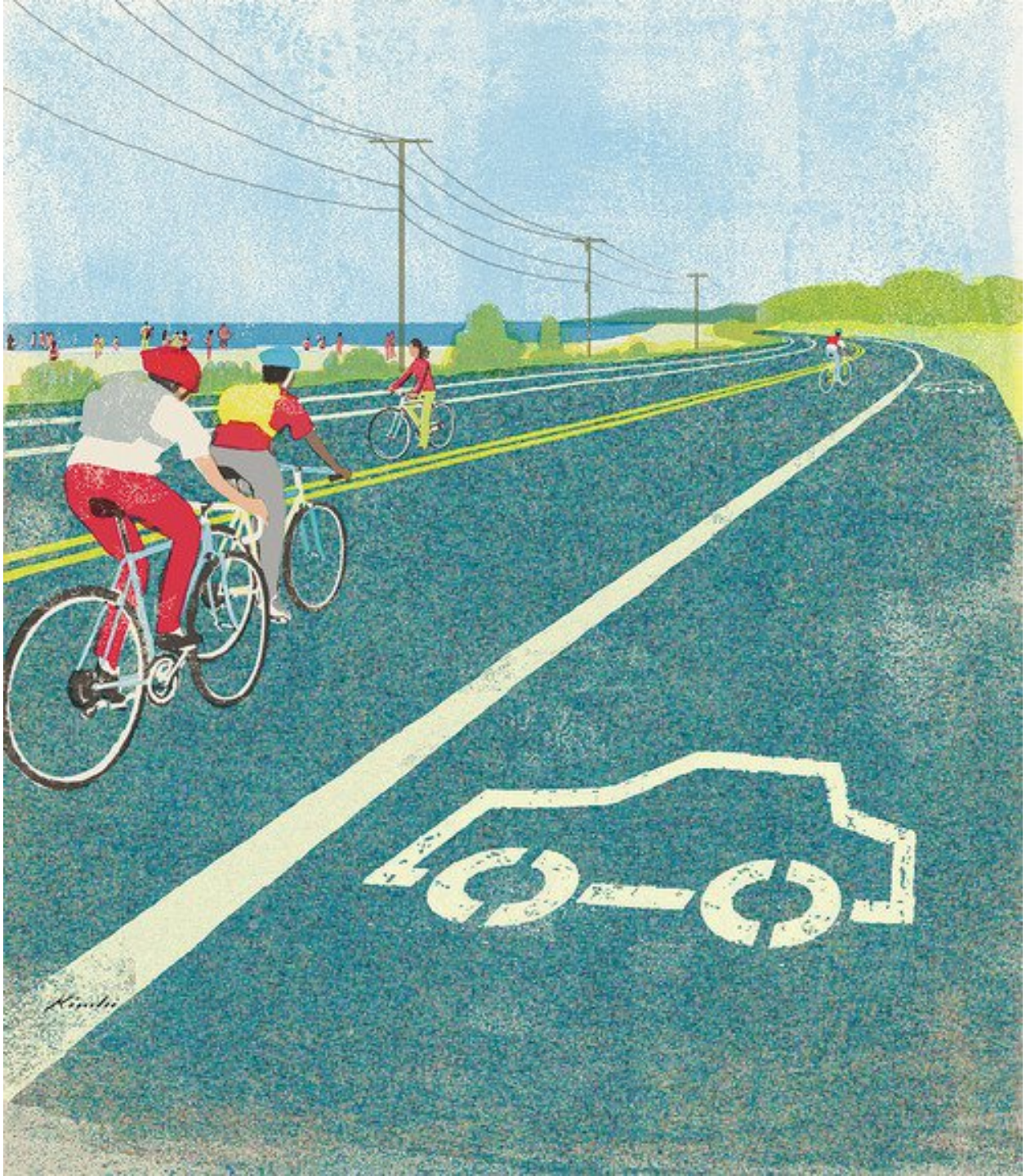
What does this all add up to?





My take on it

- What we know pretty well is that…
  - Community design can increase transit, walking, and bicycling - and reduce driving.
  - Substantial changes in the built environment may be needed to achieve meaningful changes in traveler behavior.
- What we need now are…
  - Evaluation studies that provide direct evidence that a change in the built environment leads to a change in travel behavior.
  - More research on demand for (residential location choice) and supply of (policy implementation) livable communities.





Thanks!

Questions? slhandy@ucdavis.edu